(12) UK Patent Application (19) GB (11) 2 188 003 (13) A

(43) Application published 23 Sep 1987

(21) Application No 8607083

(22) Date of filing 21 Mar 1986

(51) INT CL*
B41F 13/02 B65H 23/30

(52) Domestic classification (Edition I):
B6C 104 253 301 BAG
B8R 8D1C 8F5 RA4
U1S 2236 B6C B8R

(56) Documents cited
GB A 2153299 GB 1547087 GB 1420447
GB A 2113147

(58) Field of search
B6C
B8R
Selected US specifications from IPC sub-classes B41F
B65H

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(54) Feeding webs through flexoprinting machine

(57) In flexoprinting machines of the kind in which an impression cylinder (2) is associated with each inking mechanism (1), and the web (7) to be printed is passed over the impression cylinders (2), passed over the impression cylinders (2) is a support belt (6) which is driven in a slip-free manner and which circulates with a constant tension over a regulating means (8), and the web to be printed is in constant contact with the support belt (6) from the inking mechanism at the intake end to the inking mechanism at the discharge end. Provided between the cylinders (2) are support rolls (10) whose surfaces which contact the support belt (6) are disposed laterally outwardly. Displacement of the web to be printed between the individual inking mechanisms (1), which would reduce register accuracy, is substantially eliminated by the arrangement of the support belt (6).

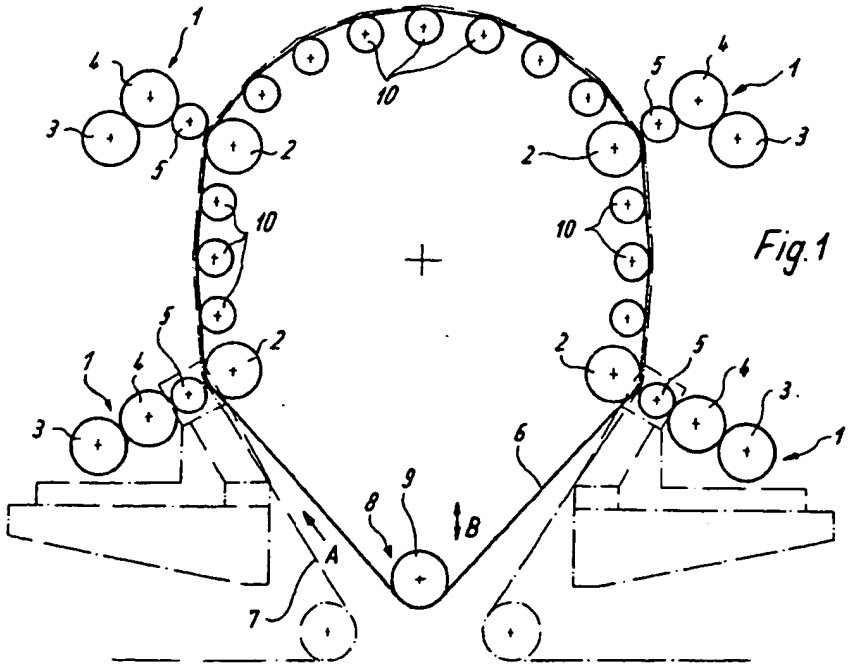

Fig.1

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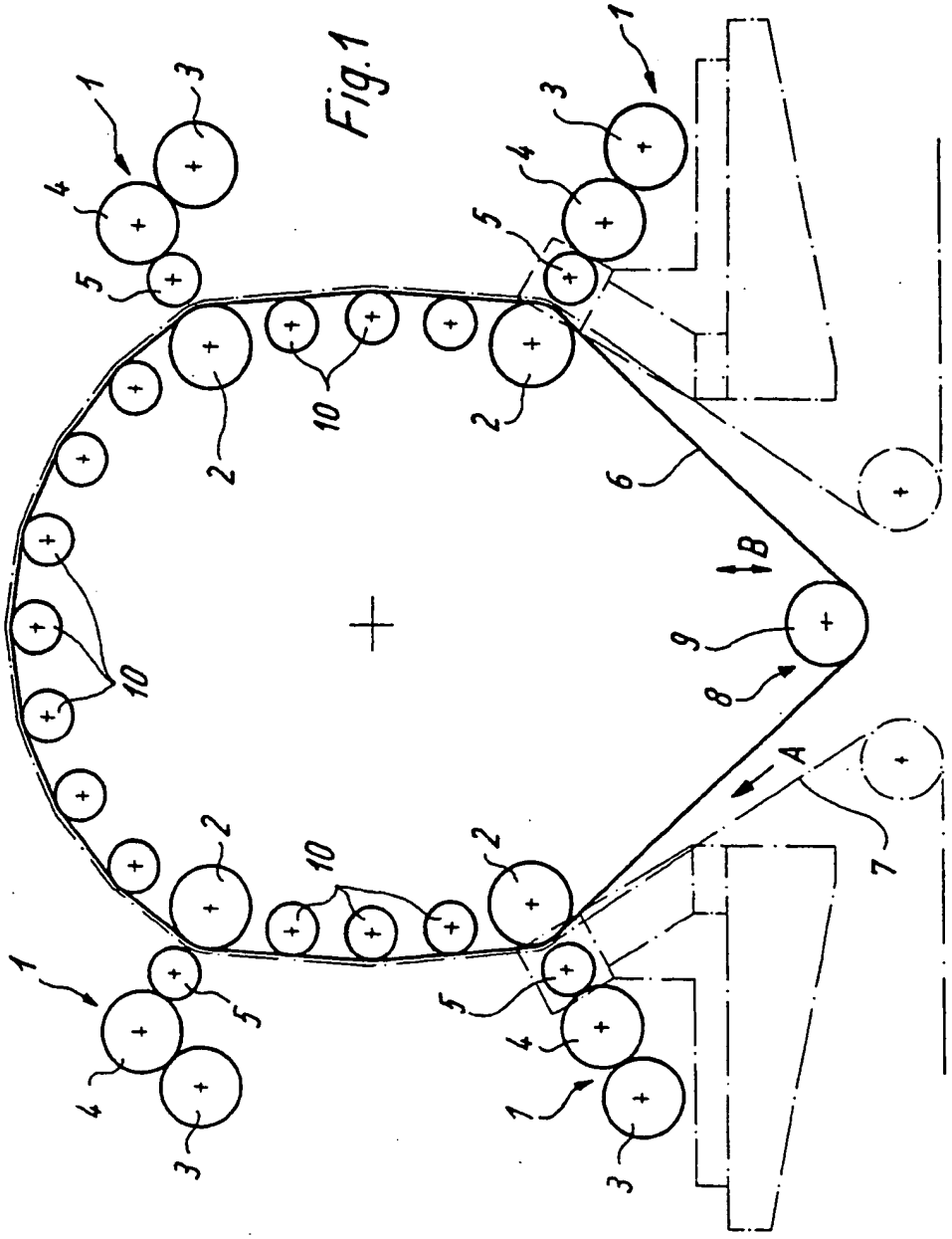
Fig.1



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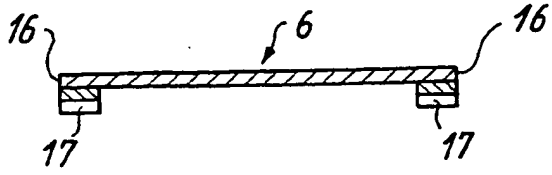

Fig. 3

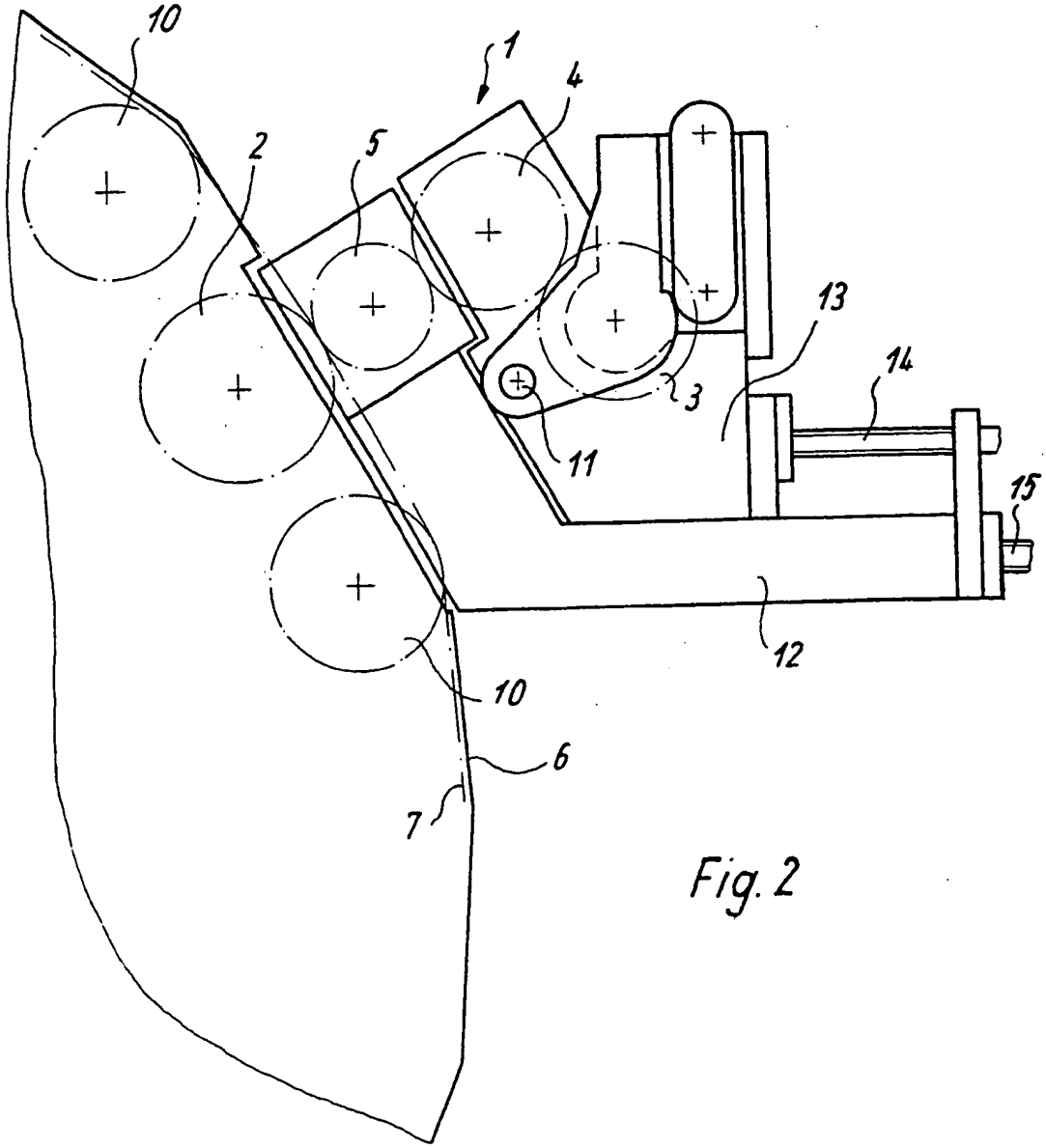

Fig. 2

SPECIFICATION

Flexoprinting machine

The present invention relates to a flexoprinting or flexographic printing machine for printing a web of, for example, paper, plastics film or the like, having at least two inking mechanisms with each of which a respective impression or counter-pressure cylinder is associated.

Printing machines of the above-indicated kind are normally provided with a maximum of six inking mechanisms which are arranged in succession, as considered in the direction of movement of the web to be printed, through the machine. Each inking mechanism substantially comprises a fountain roll which rotates in an ink box and which partially dips into the ink bath to form a film of ink, a transfer roll on to which the ink is transferred from the fountain roll, and a plate cylinder which carries the plate provided with raised surface portions, corresponding to the image to be printed. The diameter of the plate cylinder is matched to the respective print length. Associated with each inking mechanism is an impression or counterpressure cylinder over which the web to be printed is passed. The spacing of the plate cylinder from the impression cylinder can be adjusted with an extremely high degree of accuracy so that the projecting or raised portions of the plate transfer on to the web of material the particles of ink which are taken over from the transfer roll. An overall image which is formed from a plurality of regions with different colours of ink is accordingly formed in a plurality of printing operations which take place in succession. A particular criterion in regard to judging the quality of a printed image is what is referred to as register accuracy, being in the relevant art the accuracy with which the edges of the individual regions of different colours lie in relation to each other. In order to achieve an extremely high degree of register accuracy, particular care must be taken to ensure that slippage of the web between the individual inking mechanisms is avoided. In addition, it is necessary to ensure that the tension of the web remains the same while it passes through the printing machine. However, fluctuations in web tension are often inevitable as the roll from which the web is normally drawn has a certain degree of out-of-round, which results in fluctuations in the tension of the web. In addition, depending on the nature of the material to be printed, drying devices are provided between the individual ink application locations, and such drying devices give rise to changes in length, even if only slight, and thus result in additional fluctuations in the tension of the web. Therefore, for the reasons indicated above, slippage of the web between the individual inking mechanisms is unavoidable. The printing, raised surface areas of the plate are therefore so designed that the edge portions of adjoining regions overlap to a relative slight degree.

There is thus a need for a flexoprinting or flexographic printing machine with means which are of a simple construction, such that the register accuracy is increased without requiring substantial expenditure on control and regulating means.

According to the present invention there is provided a flexoprinting machine for printing a web of, for example, paper, plastics film or the like, having at least two inking mechanisms with each of which is associated a respective impression cylinder, a continuously rotatable support belt, which can be driven in a slip-free manner, passing over the impression cylinders, on which belt the web to be printed lies at least from the intake-end inking mechanism to the discharge-end inking mechanism of the machine and means associated with the support belt for maintaining the tension thereof constant.

In such a printing machine of the invention, the web to be printed is advanced at the speed of circulation of the support belt so that the circulating support belt and the web which is advanced continuously by a pulling means are moved synchronously with each other. As the web is also tensioned, it is firmly applied to the outward side of the support belt by the resulting pressure forces. As displacement between the inking mechanisms can occur only by the frictional forces being overcome, the register accuracy of the printed image is substantially enhanced. As the support belt is driven in a slip-free manner, there are no problems whatever in matching a circulatory speed to the forward feed speed of the web to be printed. The support belt not only at least substantially prevents displacement in the longitudinal direction, but in particular it also prevents displacement in the transverse direction as the support belt is to be considered like a guide means. Register inaccuracies caused by changes in the tension of the support belt are compensated for by the means for maintaining that support belt tension constant, whereby inter alia no account has to be taken of the operating temperature which occurs in the machine.

It can be assumed that the printing machine according to the invention provides at least the quality of printing which is achieved with the substantially more expensive machines, with a common impression cylinder for all inking mechanisms.

In order to ensure that the web of paper which is to be printed bears with its rear side fully against the support belt while the web passes through the machine from the intake-end impression cylinder to the discharge-end impression cylinder, it is particularly advantageous for at least one support roll for the

support belt to be provided between two successive impression cylinders as this arrangement improves guidance of the support belt. In this connection, it is particularly advantageous for the support roll or rolls to be of such a design or arrangement, that the portion of the support belt between two successive impression cylinders extends in a convex form towards the inking mechanisms associated with the impression cylinders. The web to be printed is firmly pressed against the support belt by virtue of the support rolls being of such an arrangement or configuration so that the danger of relative movement between the support belt and the paper web is still further reduced. That construction achieves the same effect as in the case of a single-cylinder printing machine, in a particularly simple manner.

As, in the case of the printing machines with which this specification is concerned, drying devices are often provided between the individual impression cylinders or inking mechanisms, the operating temperature varies. Due to the thermal situation, the prestressing of the belt varies, although such prestressing is to be kept constant within a predetermined tolerance range. That can be achieved in a particularly simple manner if a movably mounted roll is pressed against the support belt.

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:–

Figure 1 is a highly diagrammatic side view of an embodiment of a flexoprinting machine according to the invention.,

Figure 2 is a view on an enlarged scale of an example of an inking mechanism for use in the machine of Fig. 1, and

Figure 3 is a view in cross-section of an example of a support belt for use in the machine of Figs. 1 and 2.

The embodiment of a flexoprinting machine of the invention shown by way of example in Fig. 1 is equipped with four inking mechanisms 1, with a respective impression or counterpressure cylinder 2 associated with each thereof. The impression cylinders 2 are mounted in the machine frame at the end thereof in a manner which is not shown in the drawing, and are driven from the main drive of the machine by way of gears (not shown). Each inking mechanism 1 comprises in known fashion a fountain roll 3 which rotates partially in the ink bath (also not shown), a transfer roll 4 and a plate cylinder 5 whose diameter is adapted to the respective length of print. The plate cylinder 5 is therefore to be replaced when the length of print is altered. The support structure for the lower inking mechanisms is also illustrated by way of indication. The arrangement is such, in known manner, that 3 and 5 relative to each other is adjustable and the entire inking mechanism is also adjustable in relation to the associated impression cylinder 2.

Passed over the impression cylinders 2 is an endless support tape or belt 6 whose cross-section is shown as a preferred structure in Fig. 3. The width of the support belt is less than the length of the impression cylinders 2 but is at least as great as the maximum width of a web 7 to be printed. Drying devices of different kinds of design may be provided between the individual inking mechanisms 1. So that the prestressing of the support belt 6 can be kept constant within a permissible tolerance range, the machine has a regulating means 8 which in the illustrated embodiment comprises a tensioning roll 9 which is movable in a vertical direction. The tensioning roll 9 may be pressed against the support belt 6 for example by spring force, by a weight loading or by being pressed thereagainst by means of piston-cylinder units. In contrast to the illustrated construction in which the tensioning roll 9 is pressed against the inside of the support belt 6, it may also be pressed against the outside thereof, in which case as will be appreciated two further direction-changing rollers are also required. In the illustrated embodiment, the direction of travel of the support belt 6 and the web 7 to be printed is indicated by A and the direction of movement of the tensioning roll 9 is indicated by B. The direction of travel of the support belt 6 and the web 7 respectively could also be the opposite. As can be clearly seen from Fig. 1, the web 7 to be printed lies with its rear side, which is not to be printed, fully on the outward side of the support belt 6, from the inking mechanism at the intake end to the inking mechanism at the discharge end. As the web 7 is also tensioned, relative movement as between the support belt 6 and the web 7 can only occur by virtue of frictional forces being overcome. As that can be excluded as a possibility in practical operation, the machine provides a high degree of register accuracy in the printed image.

So that the web 7 also lies fully on the support belt 6 between the individual inking mechanisms, the illustrated embodiment has a plurality of support rolls 10 disposed between the individual inking mechanisms 1. The support rolls 10 may be freely rotatably mounted in the machine frame, or they may also be driven. So that the web 7 does not come away from the support belt 6, the support rolls 10 which in the illustrated embodiment are smaller in diameter than the impression cylinders 2 are so arranged that the surfaces which are contacted by the support belt are set outwardly with respect to the contact surfaces of the impression cylinders 2. If the kinking of the support belt 6, which occurs

then the support belt 6, as it circulates continuously, describes a respective arc between each two successive impression cylinders 2. As can further be seen from Fig. 1, the longitudinal axes of the support rolls 10 are displaced outwardly relative to the longitudinal axes of the impression cylinders 2. In order to achieve the same effect of keeping contact between the web 7 and the support belt 6, in a modified form of the illustrated embodiment the support rolls 10 could be of correspondingly larger diameters.

Fig. 2 shows the structure of an inking mechanism, as one possible form thereof. As can be seen therefrom, the spacing of the fountain roll 3 relative to the roll 4 can be varied by pivotal movement about a horizontal axis 11. The support structure comprises two frame portions 12 and 13 which are displaceable relative to each other, wherein, by rotating a spindle 14, the spacing of the roll 4 from the plate cylinder 5 can be adjusted, while retaining the spacing between the fountain roll 3 and the roll 4. By rotating a further spindle 15, it is possible to adjust the spacing between the impression cylinder 2 and the plate cylinder 5 or the entire inking mechanism 1. The arrangement of the rolls of the inking mechanism 1 is only one possible construction.

Further possible forms of the arrangement of the rolls of the individual inking mechanisms 1 are shown in Fig. 1, although in a practical construction the arrangement is the same in each case.

Fig. 3 shows a view in cross-section of the support belt 6. As can be seen therefrom, the support belt 6 is provided in the region of each of the two longitudinal edges 16 with a respective tooth configuration 17 which is formed in the manner of a toothed belt. Accordingly the support belt 6 can be considered as constituting a flat belt with toothed belts fitted to the longitudinal edges thereof. The support belt 6 is driven by all impression cylinders 2 which are either provided at their ends with a tooth configuration which engages into the tooth configuration 17 on the support belt 6, or toothed belt drive pulleys are fitted on to the shaft carrying the respective impression cylinder 2. It is also sufficient for only one impression cylinder to be driven by the main drive of the machine. The other impression cylinders are then driven by the support belt provided with the tooth configurations.

Fig. 1 shows a four-colour flexoprinting machine. The web to be printed extends in an inverted substantially U-shaped configuration, with the open side facing downwardly. Accordingly the impression cylinders 2 are so arranged that the axes thereof are disposed at the corners of an imaginary quadrilateral. If the machine is to be in the form of a six-colour printing machine, then a further inking mechanism and a further impression cylinder would be fitted to each side, by altering the structural height of the machine.

CLAIMS

1. A flexoprinting machine for printing a web of, for example, paper, plastics film or the like, having at least two inking mechanisms with each of which is associated a respective impression cylinder, a continuously rotatable support belt, which can be driven in a slip-free manner, passing over the impression cylinders, on which belt the web to be printed lies at least from the intake-end inking mechanism to the discharge-end inking mechanism of the machine and means associated with the support belt for maintaining the tension thereof constant.

2. A machine according to claim 1, wherein the support belt has, at its inner side which faces towards the impression cylinders, at least one tooth configuration which extends over the entire length thereof and into which is engageable a drive means of corresponding configuration.

3. A machine according to claim 2, wherein a respective tooth configuration is provided in the region of each of the two longitudinal edges of the support belt.

4. A machine according to claim 2, wherein the tooth configuration is in the form of a toothed belt.

5. A machine according to claim 1, including at least one support roll for the support belt, located between two successive impression cylinders.

6. A machine according to claim 5, wherein the support roll or rolls is/are of such a design or location, that the portion of the support belt between two successive impression cylinders extends in a convex configuration towards the inking mechanisms associated with the impression cylinders.

7. A machine according to claim 6, wherein the longitudinal centre line of the support roll or the longitudinal centre lines of the support rolls is/are outwardly displaced relative to the longitudinal centre lines of two successive impression cylinders.

8. A machine according to claim 7, wherein the diameter of the support roll or rolls is or are less than the diameters of the impression cylinders.

9. A machine according to claim 6, wherein the diameter of each support roll is greater than the diameter of the impression cylinders.

10. A machine according to claim 2, wherein at least one impression cylinder has a tooth configuration into which the tooth configuration on the support belt is engageable.

11. A machine according to claim 10, wherein each impression cylinder has a tooth configuration.

12. A machine according to claim 10 or claim 11, wherein the tooth configuration is a

toothed belt drive pulley which is fitted on to the shaft of the respective impression cylinder.

13. A machine according to claim 1, wherein the means for keeping the tension of the support belt constant is movably mounted roll which can press against the support belt.

14. A machine according to any one of the preceding claims, wherein the impression cylinders and the support rolls are located to form, when viewed from the side of the machine, a downwardly open, inverted substantially U-shaped, array.

15. A flexoprinting machine for printing a web of, for example, paper, plastics film or the like, substantially as hereinbefore described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd, Dd 8991685, 1987.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.